Percutaneous lead extraction for patients with large vegetations using an unusual technique

Nobuhiro Nishii, MD, PhD,* Akihito Miyoshi, MD, PhD,† Yoshimasa Morimoto, MD,† Hiroshi Morita, MD, PhD,* Shingo Kasahara, MD, PhD,‡ Hiroshi Ito, MD, PhD†

*From the *Department of Cardiovascular Therapeutics, Okayama University Graduate School of Medicine, Dentistry, and Pharmaceutical Sciences, Okayama, Japan, †Department of Cardiovascular Medicine, Okayama University Graduate School of Medicine, Dentistry, and Pharmaceutical Sciences, Okayama, Japan, and ‡Department of Cardiovascular Surgery, Okayama University Graduate School of Medicine, Dentistry, and Pharmaceutical Sciences, Okayama, Japan.*

Introduction

The growing evidence of the importance of cardiac implantable electronic devices (CIEDs) for improving both quality of life and survival among specific patients with heart disease has led to a significant increase in the number of these implantations.[1,2] As a result, the number of complications, including CIED-related infection, has also increased. Although transvenous lead extraction is safe and effective for patients with infections from implantable devices,[3,4] we should well consider the indication of transvenous lead extraction in patients with large vegetations measuring greater than 2.5 cm.[5,6] If a large vegetation (more than 2.5 cm) is found, open heart surgery is also indicated to prevent pulmonary embolism. However, open heart surgery is invasive and carries increased risk in patients with systemic infection.

We report successful transvenous lead extraction in 2 patients with large vegetations measuring greater than 2.5 cm using unusual techniques.

Case reports

Case 1

In the first case, a 58-year-old man was implanted with an implantable cardioverter-defibrillator (ICD) owing to idiopathic ventricular fibrillation 5 years prior to presentation. A new ICD lead was implanted because of old ICD lead failure 1 year prior. He was referred to our hospital owing to ICD infection with a large vegetation measuring greater than 4 cm. On presentation, the patient was febrile, with an increased white blood cell count and increased C-reactive protein level. Antibiotics and heparin infusion were prescribed for more than 1 week, without reduction in the volume of the vegetation (Figure 1A and B). He and his family refused open heart surgery owing to psychological disease. Transesophageal echocardiography (TEE) demonstrated that the large vegetation was adherent to the right atrium (RA) wall and tricuspid valve, but not the ICD lead. We attempted transvenous lead extraction with planned conversion to emergent cardiac surgery if needed. Under careful observation of the vegetation, the tips of both the new and old ICD leads were detached and pulled to the RA by simple traction without using any sheaths. Then, the ICD leads were extracted using a snare from the femoral vein (Figure 1C). During the procedure, the large vegetation and the patient's hemodynamic status did not change. One week after lead extraction with intravenous antibiotic infusion, TEE showed that the large vegetation was almost completely absent, and only a small vegetation less than 5 mm was attached at the tricuspid valve (Figure 1D). Enhanced computed tomography 1 week after lead extraction showed no pulmonary embolism (Figure 1E). After the infection was completely cured, a subcutaneous ICD was implanted.

Case 2

In the second case, a 72-year-old man was implanted with a dual-chamber pacemaker owing to sick sinus syndrome 5 years prior to presentation. He was referred to our hospital because of a large vegetation measuring 2.7 cm, which was adherent to the right ventricle (RV) lead (Figure 2A). He was febrile, with an increased white blood cell count and increased C-reactive protein level. He strongly refused open heart surgery. We attempted transvenous lead extraction with planned conversion to emergent cardiac surgery if needed. The atrial lead was extracted using an excimer laser sheath. The adhesions of the RV lead at the innominate vein were dissected by excimer laser sheath. During the procedure, TEE revealed that the vegetation was tightly adhered to the RV lead. The tip of the RV lead was detached from the RV

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Address reprint requests and correspondence: Dr Nobuhiro Nishii, Department of Cardiovascular Therapeutics, Okayama University Graduate School of Medicine, Dentistry, and Pharmaceutical Sciences, 2-5-1 Shikata-cho, Kita-ku, Okayama 700-8558, Japan. E-mail address: nnishi@md.okayama-u.ac.jp.

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KEY TEACHING POINTS

- Transvenous lead extraction in patients with large vegetations measuring greater than 2.5 cm should be done with care. We report successful transvenous lead extraction in 2 patients with large vegetations.
- In the first case, large vegetations were adherent to the right atrium wall and tricuspid valve, but not the implantable cardioverter-defibrillator (ICD) leads. Then, the ICD leads could be extracted using a snare from the femoral vein.
- In second case, large vegetations were tightly adherent to the right ventricular lead. Although the right ventricular lead and vegetation were smoothly pulled through the inferior vena cava, the vegetation was trapped at the right femoral vein. The vegetations were successfully removed by a percutaneous transluminal angioplasty balloon and a Fogarty catheter.
- We describe removal of leads associated with large vegetations using novel techniques.

to the RA by simple traction without advancement of any sheaths to the tricuspid valve or the RV. The lead was then captured and pulled out by a snare from the femoral vein (Figure 2B and C). Although the RV lead and vegetation were smoothly pulled through the inferior vena cava, the vegetation was trapped at the right femoral vein (Figure 3A). First, we pushed a percutaneous transluminal angioplasty balloon (balloon size: diameter 12 mm, length 40 mm) in an inflated state from the jugular vein to the femoral vein, which was cut down by the surgeon. We attempted to remove the entire mass of the trapped vegetation using the angioplasty balloon with a Fogarty-type maneuver; however, only a portion of the vegetation could be removed. A Fogarty catheter (balloon size: diameter 11 mm) was then inserted via the femoral vein and was used to successfully remove the remaining portion of the vegetation without any complications (Figure 3B and C). Enhanced computed tomography 1 week after lead extraction showed no pulmonary embolism. After the infection was completely cured, a new dual-chamber pacemaker was implanted at the opposite side.

Discussion

We experienced 2 patients with large vegetations measuring greater than 2.5 cm who were successfully treated by

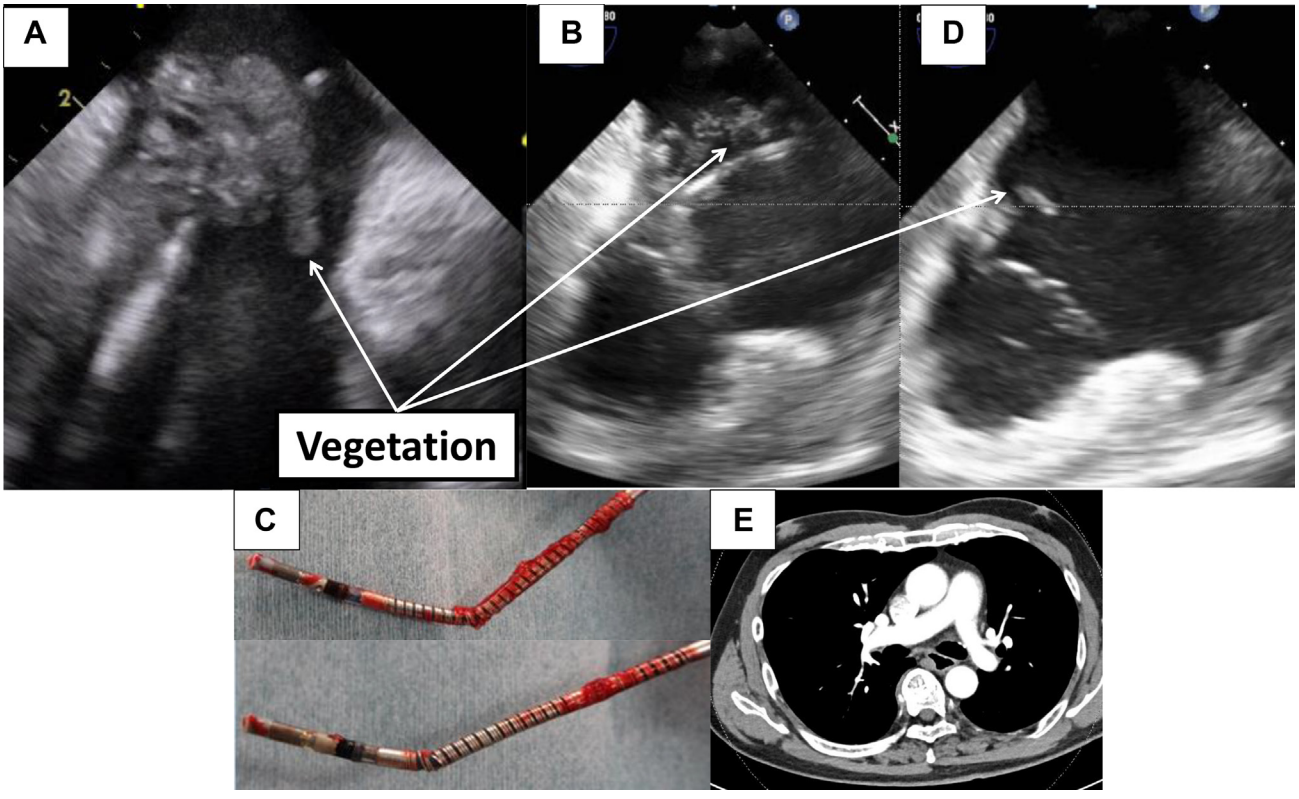

Figure 1 Large vegetation in case 1. **A:** The large vegetation, measuring greater than 4 cm, as observed by intracardiac echocardiography. **B:** The vegetation, measuring greater than 4 cm, as observed by transesophageal echocardiography. **C:** Two implantable cardioverter-defibrillator leads with small amounts of thrombus and vegetation. **D:** Residual small amount of vegetation measuring less than 5 mm as observed by transesophageal echocardiography 1 week after lead extraction. **E:** Enhanced computed tomography showed no pulmonary embolism 1 week after lead extraction.

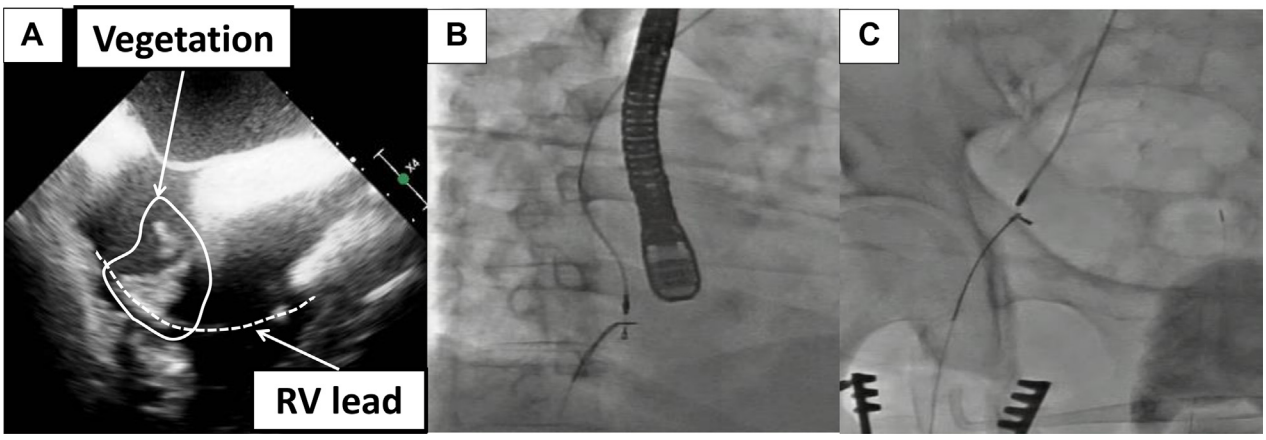

Figure 2 Large vegetation in case 2. **A:** The large vegetation, measuring 2.7 cm, was adherent to the right ventricle (RV) lead. **B:** The tip of the RV lead was detached from the RV and captured by a snare from the femoral vein. **C:** The RV lead was extracted smoothly though the inferior vena cava, but was trapped at the femoral vein.

transvenous lead extraction. We describe removal of leads associated with large vegetations using novel techniques.

In general, open surgical techniques are considered when cardiac imaging identifies large lead masses (vegetations $>$ 2.5 cm), in order to prevent critical pulmonary embolism.[5,6] Vegetations with a high probability of obstructing a main stem of the pulmonary artery, larger than 2 cm, should be removed by open heart surgery.[7]

However, transvenous lead extraction with a large vegetation has been reported. The study by Klug and colleagues[8] was the first report of transvenous lead removal for large vegetations (vegetations $>$ 1.0 cm); 40% had pulmonary embolism but there was no increased risk of mortality. Ruttmann and colleagues[7] reported that the transvenous extraction of endocardial leads with large vegetations ($>$ 1.0 cm) is feasible. They reported that although pulmonary embolism does occur, it does not influence survival. Meier-Ewert and colleagues[9] reported successful transvenous removal in 9 patients with large vegetations (diameter, 1.0–3.8 cm). Pulmonary embolism occurred in 5 patients (55%), but survival was not influenced by this complication. In the study by Grammes and associates,[10] percutaneous lead extraction with vegetations was shown to be possible and seemingly appropriate (vegetation size range, 0.2–4 cm; mean diameter, 1.6 cm). They did not find that vegetations had a significant effect on procedure-related short-term mortality. Perez Baztarrica and colleagues[11] reported that transvenous extraction of pacing leads with larger vegetations (greater than 2 cm) is a

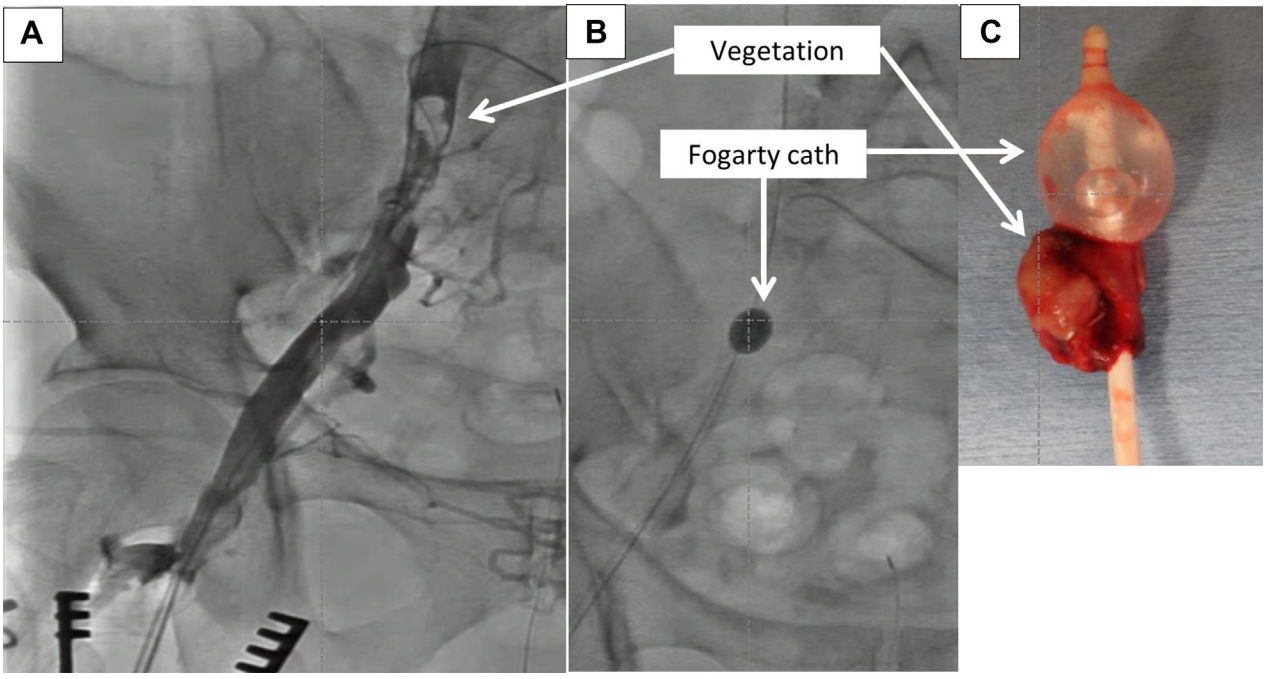

Figure 3 Large vegetation removed by Fogarty catheter. **A:** Only the large vegetation was trapped at the right femoral vein. **B, C:** The vegetation was extracted by Fogarty catheter (cath).

feasible technique. However, 2 out of 8 patients with large vegetations, measuring greater than 2 cm, developed symptomatic pulmonary embolism.

Thus, in previous reports, although survival was not influenced by transvenous lead extraction of pacing leads with large vegetations, no method has been reported to prevent pulmonary embolism. Massive pulmonary embolism can be fatal; it is thus important to prevent its occurrence during transvenous lead extraction.

In our 2 patients, pulmonary embolism could be avoided by unusual techniques. In the first case, we found that the large vegetation was fortunately not adherent to the ICD lead but was adherent to the RA wall and tricuspid valve. We were able to extract 2 ICD leads using a snare from the femoral vein. After lead extraction, infective endocarditis was successfully cured by intravenous antibiotic infusion. The precise reasons why the large vegetation disappeared 1 week after lead extraction is unknown. One speculated reason is that the removal of artificial material in the ICD lead contributed to improvement in the infection. Second, the vegetation might include areas of thrombus, and continuous heparin treatment could reduce the size of the mass. In the second case, we diagnosed a large vegetation adherent to the RV lead. We moved the RV lead with careful observation by TEE during the procedure. After recognition that the entire vegetation was moved with the RV lead and that the tip of the RV lead was detached by simple traction, we decided to perform extraction via the femoral vein using a snare. In both cases included in this report, all leads were detached from the RV by only simple traction, without advancement of any sheaths beyond the vegetation site. If the adhesion to the tricuspid valve or the RV was too strong to be detached by simple traction without usage of any sheath, the novel method could not be employed.

There were some risks of pulmonary embolism in both cases. We were prepared to perform emergent open heart surgery if critical pulmonary embolism occurred. In both cases, the tip of the lead could be detached by simple traction. This seems to be a factor associated with successful transvenous lead extraction in patients with large vegetation without pulmonary embolism.

Recently, a novel technique to suction large vegetations, called Angiovac (AngioDynamics, Latham, NY), was reported to be useful for lead extraction with large vegetations.[12,13] The Angiovac was not available for use in these 2 cases; however, the system could work for similar cases in which a large vegetation is present in the RA.

Conclusion

We experienced successful transvenous lead extraction in 2 patients with large vegetations measuring greater than 2.5 cm using unusual techniques. In special situations, transvenous lead extraction may be feasible even when the vegetation is greater than 2.5 cm.

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